

STATE OF ALASKA

*Jay S. Hammond, Governor*



Annual Performance Report for

ENHANCEMENT OF SILVER SALMON STOCKS  
IN INTERIOR ALASKA WATERS THROUGH  
TRANSPLANTS OF SMOLTS FROM  
NURSERY LAKES

by

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## RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations  
of Alaska

Project No.: F-9-10

Study No.: G-III Study Title: LAKE AND STREAM INVESTIGATIONS

Job No.: G-III-J Job Title: Enhancement of Silver Salmon  
Stocks in Interior Alaska Waters  
Through Transplants of Smolts  
from Nursery Lakes

Period Covered: July 1, 1977 to June 30, 1978

## ABSTRACT

This report presents results of a third year of evaluating the potential of nursery lakes for rearing fingerling silver salmon, Oncorhynchus kisutch (Walbaum), to smolt size prior to transplanting them to larger lakes.

Harding Lake was test netted to monitor growth of landlocked silver salmon. Salmon weighing up to 3,175 g (7 lbs) were captured. Back-calculated age comparisons indicate little growth advantage was gained by rearing silver salmon in Little Harding Lake and transplanting them as smolts to Harding Lake over planting fingerlings directly into Harding Lake.

A population estimate of silver salmon stocked in Little Harding Lake revealed a survival rate of 82% to one year of age.

## RECOMMENDATIONS

1. Population estimates of silver salmon in Little Harding Lake should be conducted to assess survival to age II.
2. Surplus age II silver salmon should be transferred from Little Harding nursery lake to Harding Lake.
3. Test netting of Harding Lake to determine survival of stocked salmon and summertime distribution of large silver salmon should be continued.
4. Studies of the larger silver salmon in Harding Lake should be conducted during the summer months to determine habitat and food preferences and interaction with other fish.

## OBJECTIVES

1. To assess growth and survival of transplanted silver salmon smolts in Harding Lake.
2. To conduct a population estimate on the silver salmon in Little Harding Lake to determine overwinter survival in a nursery lake.
3. To compare relative survival of silver salmon transplanted from Little Harding Lake into Harding Lake versus silver salmon planted into Harding Lake directly from hatchery.

## TECHNIQUES USED

Graduated mesh monofilament gill nets, 125' x 6' (38 x 1.8 m) with five mesh sizes ranging from 1/2" to 2 1/2" (12-64 mm) bar measure were used to sample fish populations in lakes as were fyke nets having two 4' x 4' (1.2 x 1.2 m) aluminum frames with the body 12' (3.7 m) in length. A population estimate was derived from Little Harding Lake using the Petersen equation described by Ricker (1958).

Scales used for age determination were mounted between glass slides. A Bruning 200 microfiche reader was used to read the scales. Fish were measured for fork length in millimeters and weight in grams.

## INTRODUCTION

To determine the feasibility of rearing fingerling silver salmon to smolt size in Interior "nursery" lakes and transplanting them into managed waters, two small lakes were selected and temporary weirs were constructed at their outlets to capture yearling silver salmon if they exhibited smolting characteristics.

A brief description of the two lakes is as follows: Little Harding Lake, located 72 km (45 miles) south of Fairbanks on the Richardson Highway has 18 surface hectares (45 acres) and a maximum depth of 10 m (34 feet). The lake has a pH of 6.7 with a total alkalinity of 36 ppm. Small northern pike, Esox lucius Linnaeus, were present in the lake but were eliminated in 1976 through the use of chemicals.

Lost Lake, 91 km (57 miles) south of Fairbanks on the Richardson Highway, has 38 surface hectares (94 acres) with a maximum depth of 12 m (39 feet) and had been chemically rehabilitated in 1973. This lake has a pH of 7.1 with a total alkalinity of 31 ppm. The temporary weir structure on the lake's outlet was repeatedly tampered with by vandals and the lake became reinfested with lake chubs, Couesius plumbeus (Agassiz), and longnose suckers, Catostomus catostomus (Forster), in 1975, terminating its usefulness in this study until it can be rehabilitated and a vandalproof outlet structure can be constructed.

## FINDINGS

### Population Estimates

Little Harding Lake was treated with rotenone on June 25, 1976 to rid the lake of a stunted northern pike, Esox lucius Linnaeus, population. Following a 57 day detoxification period and test netting for 101 net days in which no fish were caught, 48,400 silver salmon, O. kisutch (Walbaum), averaging 75/lb were planted between August 26-31. These fish originated from Blind Slough, Alaska stock and survived very well to age I. A population estimate of silver salmon in Little Harding Lake was made in June 1977. A fyke trap was very successful capturing these fish and in two overnight sets 5,529 silver salmon were captured and marked with adipose fin clips (this clip was thought to be the least harmful to the fish but upon recapture was very difficult to see and considerable handling was required to determine whether the fin was clipped). These fish were then released and allowed to mix in the lake for 7 days before recapture. Out of a sample of 950 recaptures 133 had identifying marks giving a population estimate of 39,493 with a 95% confidence level range of 34,116 to 46,882. This high survival rate of 82% was attributed to the absence of predators and good feeding conditions.

A sample of 23 Little Harding Lake yearlings captured on July 11, 1977, ranged in length from 120 mm to 134 mm with a mean of 127 mm. Weight ranged from 16 g to 22 g with a mean of 18 g or 55.4/kg (25.2/lb). This compares favorably with smolts captured from Little Harding Lake in 1973 (36.3/lb) and in 1975 (14/lb).

### Relative Survival

Seventy-seven net days of effort in June and August 1977 resulted in a catch of only seven age I and one age III silver salmon in Harding Lake (Table 1). Although 314,000 silver salmon were stocked in 1975 no age II fish were captured. This is not believed to be indicative of an extremely low population, or poor survival but rather reflects the difficulty of locating the salmon in this large, (2,500 acre) deep (145') lake during summer months. The salmon probably spend the summer months away from shoal areas and beneath the thermocline, thus escaping predation by a large northern pike population (125 pike were captured in the netting operations in 1977) and finding favorable water temperature, but also making them very difficult to catch by conventional gill netting operations. All depths and all habitat types were test netted with no success during the summer. The small number of fish captured precluded an estimate of survival.

In late September mature salmon are more vulnerable to nets as they seek spawning areas. The 20 large silver salmon captured in the fall were all caught within 30 mm (100') of shore in 18 net days of effort.

All age III silver salmon caught were from a transplant of 2,301 fish reared to smolt size in Little Harding Lake and transplanted into Harding Lake in 1975. Although these fish reached substantial size (up

Table 1. Silver salmon sampling summary of Harding Lake, 1977.

Date	Age	No.	Fork Length (mm)		Weight (g)		Hatchery or Nursery Lake Plant
			Range	Mean	Range	Mean	
6/10	I	4	125-135	129			Hatchery
8/18-19	I	3	190-195	193			Hatchery
9/28-30	I	2	209-216	212	113-170	142	Hatchery
6/24	III	1		315		397	Nursery Lake
9/27-30	III	20	381-597	496	680-3,175	1,678	Nursery Lake

Table 2. Back-calculated length at each year of life of silver salmon, Harding Lake, 1976-1977.

Age at Capture	Origin	N	Mean Fork Length at Annulus Formation (mm)		
			L	L	L
			1	2	3
<u>1976</u>					
I	Hatchery	7	121		
II	Nursery Lake	23	103	183	
III	Hatchery	21	108	187	328
Weighted mean (mm)			108	185	328
Mean fork length (in)			4.3	7.3	12.9
Average annual (mm)			108	77	143
Growth increment (in)			4.3	3.0	5.6
<u>1977</u>					
I	Hatchery	8	113		
II	Hatchery		NO FISH CAPTURED		
III	Nursery Lake	19	126	216	324
Weighted mean (mm)			122	216	324
Mean fork length (in)			4.8	8.5	12.8
Average annual (mm)			122	94	108
Growth increment (in)			4.8	3.7	4.3

to 3.2 kg or 7 lbs), larger fish were caught in 1976 (up to 4.4 kg or 9 3/4 lbs) and these fish had been planted as fingerlings directly into Harding Lake (Kramer, 1977).

Table 2 shows the back-calculated length of silver salmon at each year of life in Harding Lake. The age III salmon transplanted from Little Harding Lake and the growth patterns compare very closely with age III silver salmon planted directly from the hatchery (Kramer, 1977). There appears to be little growth advantage gained in the use of the nursery lake system to rear fish to smolt size and then transplanting them. The value of the nursery lake program as it relates to increased survival has not been determined. Techniques for determining survival of these silver salmon should be developed and tested to see if there is any benefit derived by using a nursery lake system.

#### Improvements

In late fall of 1977, a new smolt trap and water control structure was constructed at the outlet of Little Harding Lake to facilitate removal of silver salmon smolts from the lake. A small gravel road and turnaround area were also added to the facility.

#### LITERATURE CITED

- Kramer, M. J. 1977. Enhancement of silver salmon stocks to interior Alaska waters through transplants of smolts from nursery lakes. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, F-9-9, 18(G-III-H): 65-86.
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